vered in this county of ſuch high antiquity; and will ſatisfy the learned, that the Romans had penetrated into the weſternmoſt parts of Cornwall before the empire became Chriſtian: that the ſacrifical veſſels, the pateræ, and præfericulum, are of tin, the natural product of Cornwall: the vaſe, the weights, the millſtone, are alſo of Corniſh granite: and by the walls, the religious utenſils, the weights, the quantity of ſhoes, bones, horns, vaſes, urn, and aſhes, this fort appears to have been that of a fixed garriſon, not a temporary occaſional fortification: that by the ſhape of this fort, and the antiquities diſcovered in it, it was a Roman fort.

I remain,

SIR,

Your moſt obedient Servant,

William Borlaſe.

IV. *A new improved* Silk-Reel. *By the Rev.* Samuel Pullein, *M. A.*

Read Feb. 1, 1759.

THE following paper, it is hoped, will help to promote the culture of ſilk in our American colonies, and to bring it to that perfection, which at preſent is ſcarce found in any country but Piedmont.

When ſilk is reeled from the cocoons, the thread is ſmeared with the natural gum of the ſilk ſoftened by the heat of the water out of which it is reeled. If

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If the ſeveral rounds of this thread, as it falls on the reel, touch one another in their whole extent, it is then ſo glued together, as to be intirely uſeleſs for any perfection of manufacture, it being impoſſible to wind it off without tearing and breaking. This fault in the ſilk countries goes under the technical name of the Vitrage; and there are many degrees of it, according to the cauſe by which it is produced.

From the introduction of ſilk into Europe to this day, the preventing of the Vitrage has employed ſome of the moſt knowing men in the countries where ſilk is produced.

To change the poſition of the ſilk thread, that it might not always fall on the ſame part of the reel, the guideſtick was introduced. This received a progreſſive and regreſſive motion, by means of two wheels, the one fixed to the axle of the reel, and communicating its motion to the other by means of a band. To make theſe wheels perfect, certain determined and preciſe proportions are to be obſerved in the diameters of their grooves, otherways, notwithſtanding the motion of the guideſtick, there may be a total Vitrage of the whole hank of ſilk; and, even when the proportion of the wheels is perfect, there may be reckoned up thirteen or fourteen accidents, any of which happening will cauſe a Vitrage: but tho' theſe inconveniencies attend all thoſe reels which uſe a band, yet, becauſe the ordinary ſort of them are eaſily made, they are ſtill uſed by the common people in moſt ſilk countries.

No nation has brought its ſilk to a greater perfection than the Piedmonteſe: but it was only by ſlow degrees, and in a long tract of time, that they arrived

rived at this. They firſt ſuppreſſed the old method of reeling the ſilk over a bobin, which was found to give it a flat form; and they ſubſtituted in its ſtead that excellent method of the croiſſure, which renders it round and compact. They then applied themſelves to correct the imperfections of the guide-ſtick, and to eſtabliſh proper proportions between the wheels which gave it motion: but, notwithſtanding theſe and other improvements, they ſtill found, that, ſo long as theſe wheels were turned by means of a band, they could not arrive at the perfection neceſſary to make ſilk fit for organcine or warp, becauſe the inaccurate motion of the band made the moſt juſt proportion which they could eſtabliſh between the wheels quite ineffectual, and conſtantly produced a Vitrage.

It was on this account that they totally ſuppreſſed the uſage of the band, and ſubſtituted in its ſtead four wheels with a determined number of teeth, whoſe revolutions, being uniform, gave the guideſtick a proper motion for preventing the Vitrage. This, and ſome other regulations, are eſtabliſhed by laws, which are rigorouſly put in execution, leſt the common people ſhould thro' indolence relapſe into their old cuſtoms. By adhering to this reel, the Piedmonteſe are able to give that perfection to their raw ſilk, which fits it to be thrown into organcine or warp; and to raiſe the value of each pound of ſilk reeled in this manner to one third more than it would have if reeled otherways.

The French were deſirous of making raw ſilk fit for organcine or warp among themſelves, which hitherto they have had from Piedmont. Whether they thought the Piedmonteſe reel could not eaſily be brought into common uſe, or whether a little vanity hindered them from copying or improving the inventions of other nations, I will not determine. However that be, they applied themſelves wholly to the improvement of the band-reel.

Two perſons, *viz.* M. St. Prieſt of Languedoc, and M. Vaucançon of the Academy of Sciences at Paris, have, within theſe three or four laſt years, brought the band-reel to the greateſt perfection of which it is capable. Either of their reels will make raw ſilk fit for organcine or warp, provided they are accurately made; but a ſmall error in their conſtruction deſtroys their perfection. I have now in my poſſeſſion a reel made according to M. Vaucançon's method; where I can ſhew, that in two wheels, whoſe diameters differ but very inconſiderably, one ſhall reel the ſilk properly, and the other throw it into a total Vitrage. I have however given a deſcription and plate of this reel, in a treatiſe on the culture of ſilk, which I publiſhed laſt year, becauſe its contrivance is more ſimple than that of M. St. Prieſt, and performs as well.

The Piedmonteſe reel is free from the inconveniencies of all thoſe reels which uſe a band: the maker cannot eaſily err in the conſtruction; the weather cannot affect its operation; nor is it ſubject, during its work, to the many irregularities of the band-reel. The chief objections which have hindered its being commonly uſed are, that four toothed wheels are more difficult to be made than two plain grooved ones; and that being made only of wood, they are eaſily broken. So that it is neceſſary to have a double ſet of them, in order to prevent thoſe delays which might happen by their breaking; becauſe any delay in the reeling of ſilk occaſions a conſiderable detriment.

Our happier conſtitution doth not admit ſuch rigorous laws as that of Piedmont. To make the common people adopt any new contrivance, they muſt not only know that it is the beſt, but they muſt alſo feel that it can be eaſily practiſed. Thoſe who ſuperintend public filatures in our colonies may indeed, for the preſent, keep their workmen to the Piedmonteſe reel; but public filatures can no more produce large quantities of ſilk than public ſpinning-houſes could produce the vaſt quantities of linen-yarn which are now raiſed from private family-wheels: And when the management of ſilk-worms becomes more common in our colonies, and people find that, by reeling their own cocoons, their profit will be nearly doubled, and this with much leſs labour than was uſed in rearing the worms; when this, I ſay, ſhall happen (and it is to be hoped it ſoon will), then the making of the Piedmonteſe reel more ſimple, and more familiar to the common people, will I believe appear a thing of conſiderable importance to our ſilk manufactures.

I ſome time ago turned my thoughts to the effecting of this; and ſhould before now have put them in execution, had I not diſtruſted my own abilities to perform a thing, which the Piedmonteſe themſelves had not attempted. I have now conſtructed a reel, which, without any additional mechaniſm, performs the work of the Piedmonteſe reel, and uſes but two wheels with teeth inſtead of four wheels. It has been examined by ſome gentlemen in the ſilk-trade, who are well acquainted with the reels of that country, and allowed to work with much more ſimplicity, and greater perfection. Nor can I account why this improvement was not before attempted, but from the ſtrong biaſs of habit confining the powers of invention.

Some advantages, which this reel ſeems to have above the preſent Piedmonteſe reel, are, 1ſt, that by a new proportion ſtruck between the wheels, the ſilk thread will not be laid in the ſame place on the reel till after the winding of near ſix hundred yards: by which means, the thread having time to dry, all Vitrage is avoided; whereas thoſe now uſed do not reel above an hundred and fifty yards till the thread is laid in the ſame place.

2dly, I have added to this reel an improved method of making the double croiſſure in as eaſy a manner as the Piedmonteſe now make the ſingle one; the double croiſſure giving a conſiderable perfection to the ſilk above what it obtains from the ſingle one.

As the limits to which I purpoſe confining this memoir will not allow of a more extended deſcription, which, to gentlemen not verſed in theſe matters, may already be thought too long, I ſhall avoid a greater treſpaſs on your attention, by a brief reference to the annexed figure [*See* Tab. II.], and to the model before you [*See* Tab. III.].

Tab. II. repreſents the preſent Piedmonteſe reel. The poſition of the four wheels is ſhewn at A, B, C, and D: the toothed wheel A is fixed upon the axle

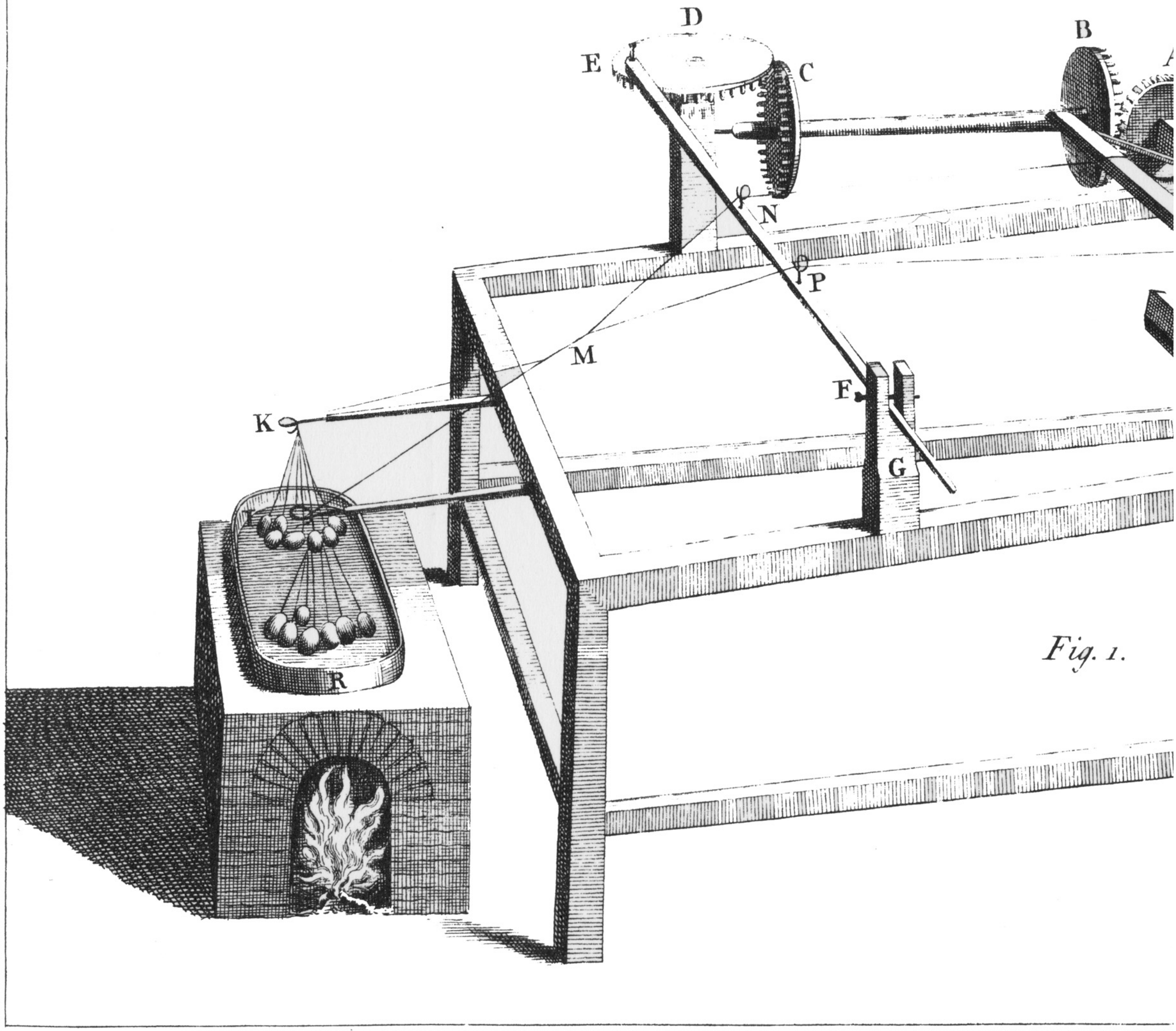

Fig. 1.

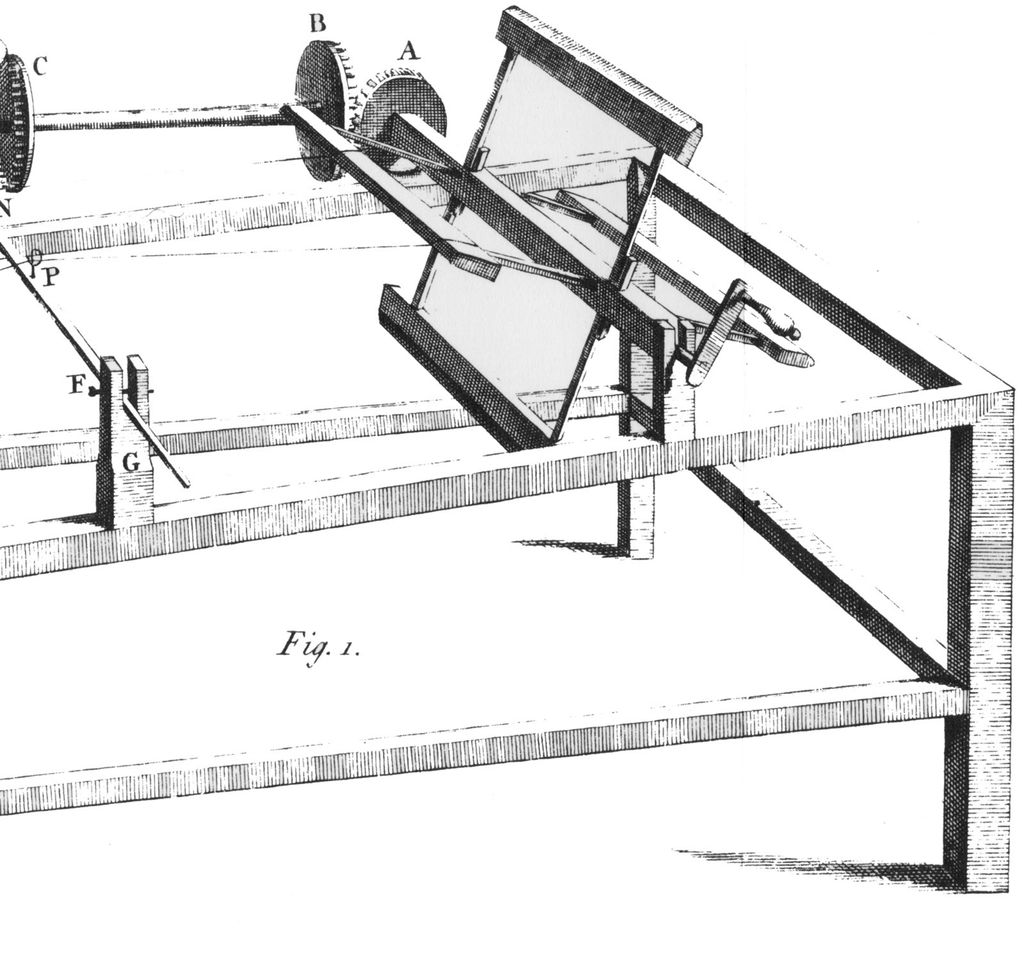

Fig. 1.

J. Mynde sc.

of the reel; and, as the reel turns, it gives motion to the two wheels B and C, which are fixed upon one common arbre. The wheel C moves the wheel D, which is placed horizontal; and this, as it revolves, makes the guideſtick E F play forward and backward in a groove made in the upright G, the guideſtick playing freely on a pin E fixed in this wheel. Two threads of ſilk, drawn from two parcels of cocoons, which lie in the copper of hot water R, are paſſed thro' the two loops of the ſtop-wires K and L: they then are twiſted round each other at M, which is the ſingle croiſſure of the Piedmonteſe. At M they are again ſeparated, and paſs each through its own guide-wire at N and P; and from theſe they go to the reel, where, as the reel turns, the motion of the guideſtick continually varies their poſition, and hinders them to be laid on the ſame place.

The model before you, repreſented by *Tab.* III. exhibits the new conſtruction which I have given to this reel. The two wheels C and D of *Tab.* II. are laid aſide as ſuperfluous: the arbre Q paſſes thro' a nich in an upright ſupporter R, and, by a winch at its end A, gives motion to the guideſtick. The plane of its motion in the Piedmonteſe reel is horizontal, but here it is perpendicular. This perhaps made them think that the effect would not be the ſame: but it doth not cauſe any eſſential difference; and if it had, there was a moſt eaſy remedy for it.

Here therefore the expence and trouble of making and adjuſting two wheels and two ſets of teeth are ſaved, the hazard of breaking and going out of order leſſened, and the machine made more ſimple, and more familiar to the underſtanding.

As I intend, at a convenient time, to give a more ample account of the method in which ſilk is reeled, and of the various attempts which have been made to improve the ſilk-reel, together with their ſucceſs, that perſons may not waſte their time upon fruitleſs experiments; and having hopes alſo that I ſhall be able to add ſome further improvements to it, of which I have not as yet had leiſure to make trial; for theſe reaſons I ſhall for the preſent take leave of this ſubject, at leaſt with this pleaſing thought, that the pains I have taken may poſſibly hereafter promote the induſtry and profit of ſuch poor families as are, in all countries, the ſupporters of the ſilk manufacture.

Samuel Pullein.

In *Tab.* III. *fig.* 1. at A is ſhewn the manner in which I have made a winch D, fixed in the arbre Q A, anſwer the ſame purpoſe as the two wheels with teeth, which are uſed in the Piedmonteſe reel; by which the mechaniſm is rendered more ſimple, and the guideſtick F moved to the ſame advantage as with the wheels.

At *fig.* 2. is ſhewn the double croiſſure, made by means of the croſs B, which I ſhall call a ſwivel-croſs. It is made of very ſlight ſcantling, ſuch as a common lath may afford. At *b b* are fixed two little ivory or braſs wheels with ſmooth acute-angled grooves in them to receive the threads which come from the two ſtop-wires *b b*. One end of the ſwivel-croſs K is ſomewhat broad, and reſts upon the guide-ſtick F directly in the middle between the two guide-wires *c c*. Here it moves and plays freely

Fig. 2.

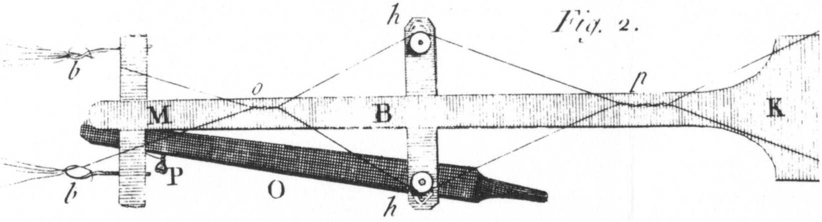

Fig. 1.

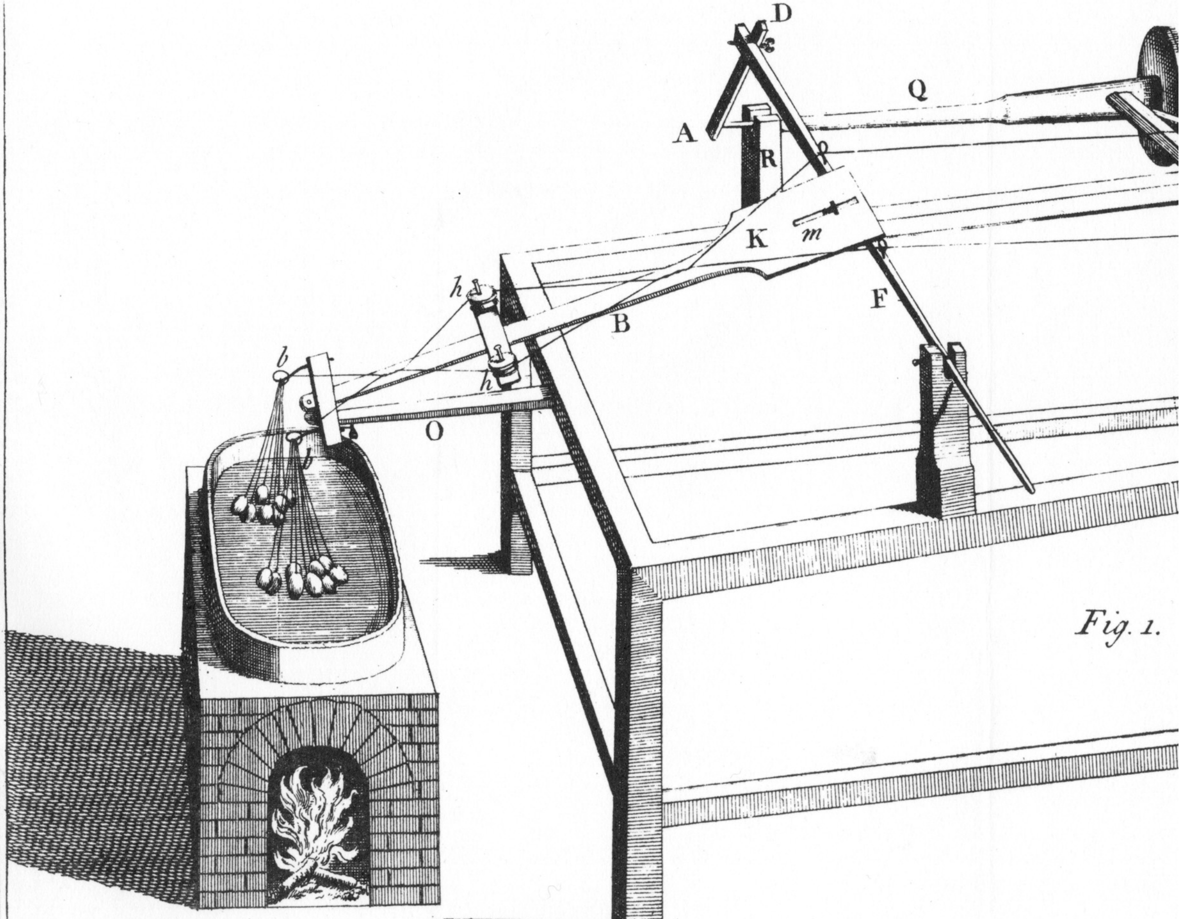

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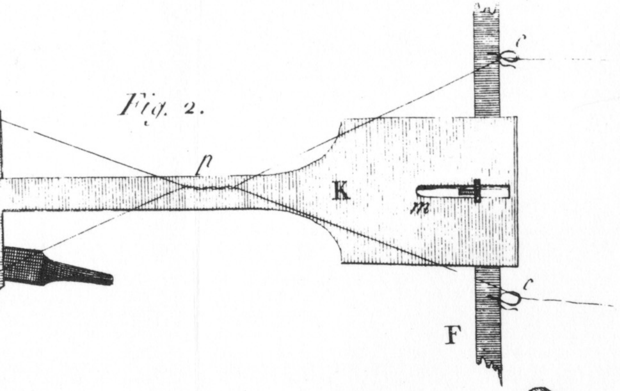
Fig. 2.



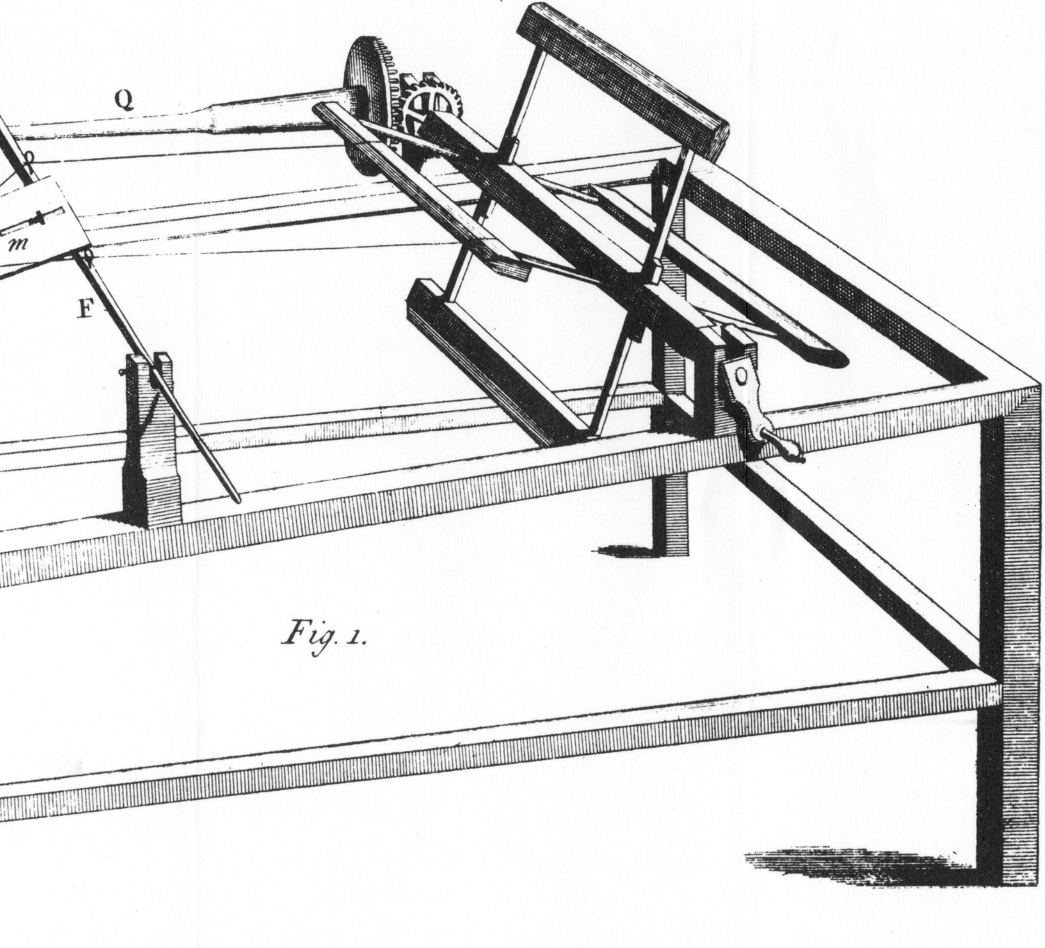


Fig. 1.

J. Mynde sc.

on a pin fixed in the guideſtick, the pin paſſing thro' the nich *m*. The other end of the ſwivel M contains the ſtop-wires *b b*, and is attached to the end of the rod O, which projects from the front bench of the reel. This attachment is made by means of a piece of packthread with a knot on its end; which packthread paſſes thro' a hole in the ſwivel and in the piece O, and being fixed to a peg P, which turns in the under part of the piece O, is drawn to a proper degree of tenſion to allow the ſwivel to obey all the motions of the guideſtick.

The manner of making the double croiſſure is thus: The two ſilk threads are paſſed thro' the two ſtop-wires *b b*, and thro' the two guide-wires *c c*, and ſo are faſtened to the reel. Then either of the two threads is taken in that part of it which lies between the ſtop-wire and and guide-wire, and turned two or three times round the other thread; and then each thread is placed in the groove of the pulley at *h h*, taking care to place each in the groove of that pulley which lies on the ſide of its own ſtop-wire. The threads will then appear in the ſituation repreſented in the figure twiſted round one another in the two points *o* and *p*.

The great advantage of this method is the taking off the preſſure of the threads, by making them paſs over two pullies inſtead of two hooks; and by the ſwivel complying with all the motions of the guideſtick, which keeps the angles of the croiſſure conſtantly the ſame: without this, the bearing of the threads and the variation of the angles will make them ſo liable to break, that, from many experiments which I have made, I might venture to ſay, that

that tho' the double croiſſure has many advantages in compacting the ſilk thread, and ſhaking off its moiſture, yet without ſuch contrivance it will ſcarce ever be put in practice. I muſt alſo take notice, that this contrivance is vaſtly more ſimple than that which Monſ. Vaucançon uſes, tho' his has no one of theſe advantages. A deſcription of his method may be ſeen in the treatiſe which I lately publiſhed on the culture of ſilk, for the uſe of our American colonies, ſold by Mr. Millar in the Strand; but I had not at that time thought of theſe improvements.

N. B. In *Tab.* III. *fig.* 2. the ſwivel-croſs is repreſented ſomewhat large, and ſeparate from the reel, the better to diſtinguiſh its parts; but at B, *fig.* 1. it is ſhewn in its true proportion and ſituation when the reel is ready to work.

V. *Experiments on ſeveral Pieces of Marble ſtained by Mr.* Robert Chambers. *In a Letter to the Rev.* Thomas Birch, *D. D. Secret. R. S. from Mr.* Emanuel Mendez da Coſta, *F. R. S.*

Rev. Sir,

Read Feb. 8, 1759.

I Take the liberty to addreſs to you ſome notices on the art of ſtaining or painting of marble, and the experiments I made on thoſe pieces of painted marble produced before this Society, at their meetings on the 21ſt December and 11th January laſt.

The

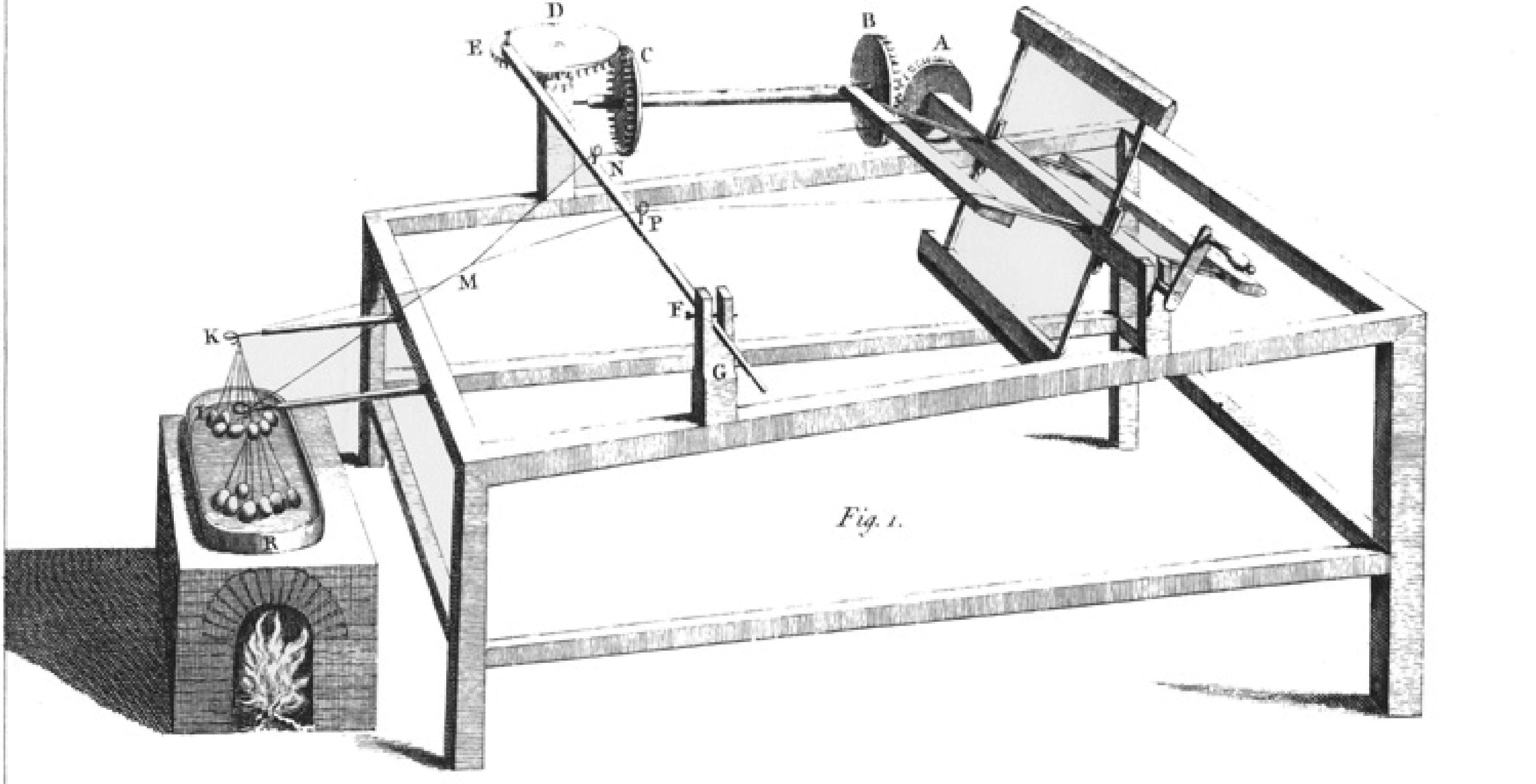


Fig. 1.

J. Mynde sc.

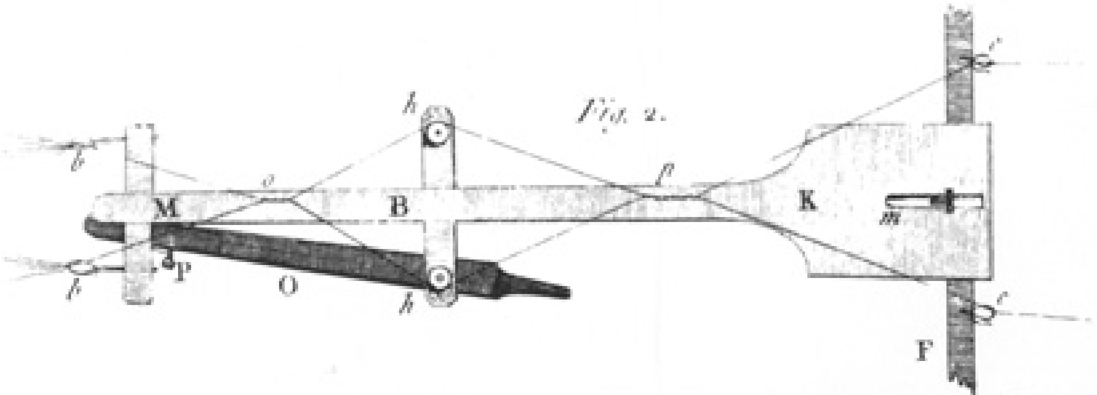


Fig. 2.

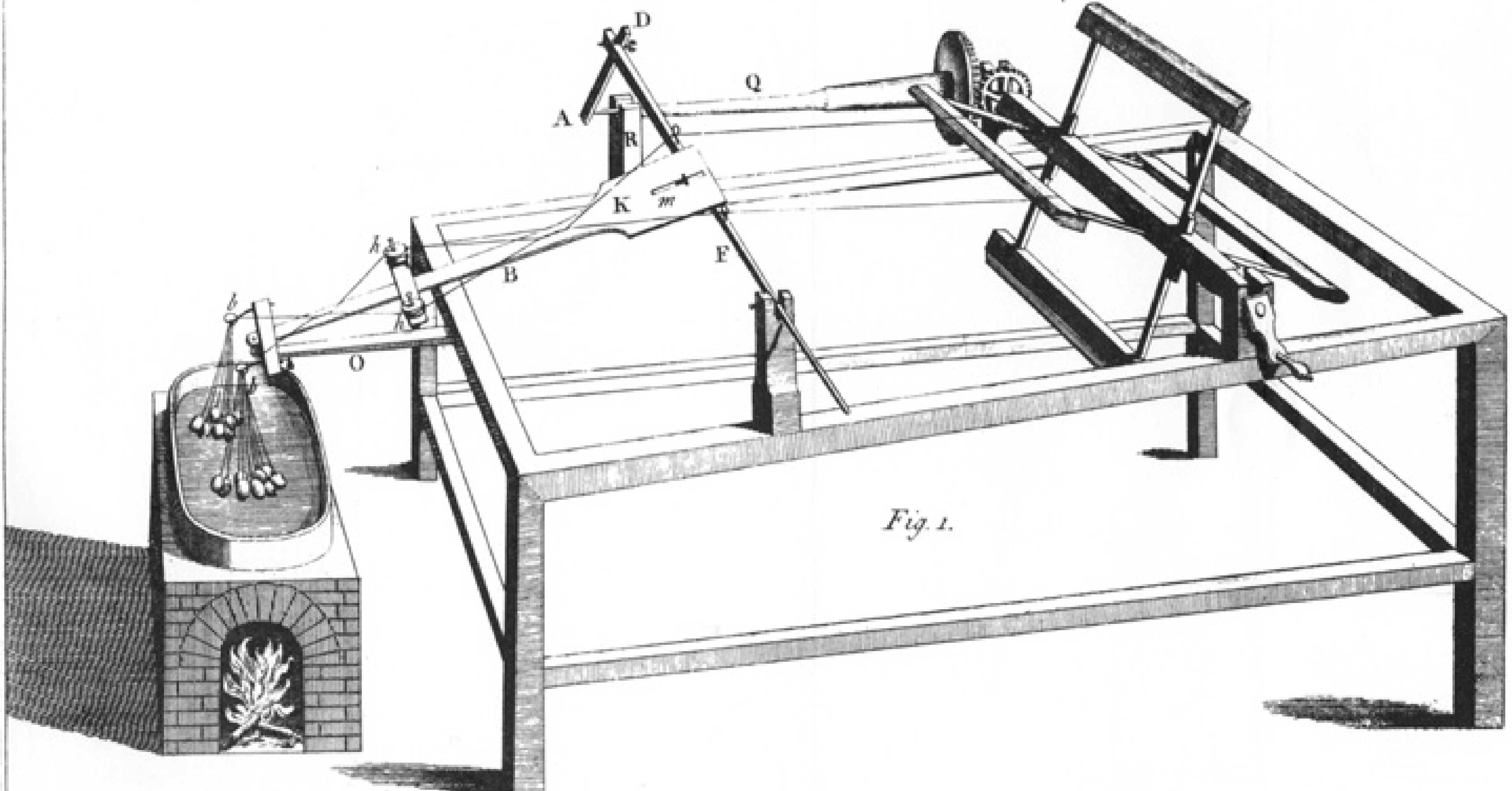


Fig. 1.

J. Mynde sc.